

REMARKS/ARGUMENTS

A. Summary of the Amendment

By way of the present amendment, claims 1, 7, and 13 are amended. Claims 19 to 25 have been withdrawn as the result of an earlier restriction requirement. Thus, claims 1 to 18 remain pending for the Examiner's consideration, with claims 1, 7, and 13 being independent claims. Reexamination and reconsideration are courteously requested.

B. Rejections Under 35 U.S.C. §§ 102(3)/103(a)

Claims 1 to 18 are rejected as being either anticipated by, or unpatentable over, U.S. Patent No. 6,974,777 (Moeggenborg). These rejections are respectfully traversed, at least in view of the present amendment. The invention as set forth in pending claims 1 to 18 includes a non-abrasive chemical mechanical polishing (CMP) fluid that includes a high molecular weight surfactant. Nowhere in Moeggenborg is there any teaching or suggestion of the particular molecular weight range of 2000 to 240,000 for aliphatic surfactants. In columns 3 to 5 of Moeggenborg, hundreds of surfactants are disclosed, each having different molecular weights or weight ranges. Moeggenborg fails to disclose any particular weight ranges for the hundreds of surfactants, or any particular benefits that would be provided by using a high molecular weight aliphatic surfactant such as those presently claimed. For at least this reason, it is clear that Moeggenborg fails to anticipate or render obvious pending claims 1 to 18.

Claims 1 to 18 are also rejected as being unpatentable over U.S. Patent No. 6,270,393 (Kubota) in view of Moeggenborg, or alternatively, over Kubota in view of Moeggenborg and U.S. Publication No. 2004/0234396 (Hattori). These rejections are respectfully traversed, at least in view of the present amendment.

The pending claims recite a non-abrasive polishing fluid for use with a fixed abrasive chemical mechanical polishing pad, the polishing fluid including a high molecular weight aliphatic surfactant (m.w. 2,000 to 240,000). In the office action, the Examiner cites Kubota as

meeting all of the features recited in the independent claims, but concedes that Kubota fails to disclose that the CMP fluid is abrasive-free. However, the Examiner asserts:

“With regards to using an abrasive free solution with a fixed abrasive pad, it is noted that in a CMP polishing system an abrasive slurry may be used with a non-abrasive polishing pad, or in the alternative an abrasive-free slurry may be used with a fixed abrasive pad, i.e., the abrasive particles in the system be suspended in the solution or in the pad, as evident by Moeggenborg et al. It would have been obvious ... to modify the chemical-mechanical polishing system of Kubota et al. by incorporating the abrasive in the polishing pad in lieu of the solution, i.e., an abrasive free solution as taught by Moeggenborg et al. as an alternative means depending on the workpiece/operational parameters.”

The prior art does not teach or suggest that a polishing system incorporating an abrasive pad and non-abrasive slurry is equivalent to a system incorporating a non-abrasive pad and an abrasive slurry. This is because Kubota *only* discloses the use of *both* an abrasive slurry and an abrasive polishing pad together in the same system (col. 6, lines 36 to 38). Moreover, Moeggenborg discloses that it is preferable to employ a system that uses both an abrasive CMP fluid together with an abrasive polishing pad (col. 3, lines 11 to 22). Also, in all of the examples set forth in Moeggenborg, an abrasive is included in the CMP fluid (Examples 1 to 5). Moeggenborg may implicitly allow for abrasive-free CMP fluid, but never explicitly provides any instruction or usefulness for such a fluid. Hattori also discloses the use of an abrasive polishing fluid together with an abrasive polishing pad (the pads in par. 0086 all incorporate abrasive material). Thus, in no way do Kubota and Moeggenborg, alone or together with Hattori, teach or suggest that it would be obvious to modify the system of Kubota by removing the abrasive particles from the CMP fluid.

Furthermore, the claims as presently amended recite an abrasive-free CMP fluid that includes, *inter alia*, an aliphatic surfactant with a high molecular weight of 2,000 to 240,000. It is respectfully pointed out that the present specification clearly and unambiguously discloses a unique and beneficial synergy between the high molecular weight aliphatic surfactant and the non-abrasive polishing fluid.

For instance, abrasive polishing fluids that include abrasive particles or abrasive slurries have some inherent disadvantages as set forth in paragraph 0006:

“When pressure is applied between [a] polishing pad and [a] wafer, mechanical stresses are concentrated on the exposed edges of the adjoining cells in the polishing pad. Abrasive particles within the [prior art] fluid concentrate on these edges and tend to create zones of localized stress on the wafer in the vicinity of the exposed cell edges. The above combination of chemical and mechanical stress creates localized pressure on the wafer and produces mechanical strain on the chemical bonds that form the surface being polished.”

Paragraph 0039 discloses that this problem is overcome by using a fluid that does not include abrasive particles. When polishing using the abrasive-free polishing fluid, “the removal rate for wafer high areas is very high during polishing, while the removal rate for wafer low areas is very low.” Also, as explained in paragraph 0054, while the abrasive-free fluid produces a high polishing rate in high areas, the high molecular weight surfactant reduces a dishing effect that is produced when polishing with low molecular weight surfactants. Dishing is the result of over-polishing in particular high friction areas of the wafer surface, and the present inventors found that the synergistic results of high removal rates without the dishing effect is achieved by polishing using an abrasive-free polishing fluid with an aliphatic surfactant having a high molecular weight of between 2,000 and 240,000.

Furthermore, the polishing pad lasts longer when using the abrasive-free fluid of the present invention. There is little to no abrasive build-up around exposed edges of adjoining cells in the polishing pad, and consequently no localized pressure that would produce mechanical strain on the chemical bonds that stabilize the polishing pad surface.

Paragraphs 0057 to 0060 details tests performed to compare the non-abrasive polishing fluid of the present invention with conventional polishing fluids having abrasive particles or slurries. As summarized in paragraph 0060:

“From these results it is clear that the CMP fluid of the present invention provides higher selectivity and overall consistency than the tested conventional CMP slurries when used for polishing wafers with a fixed abrasive CMP pad.”

Even if the cited prior art references are combined, there is no teaching or suggestion of the specific range of molecular weight aliphatic surfactants in a non-abrasive CMP fluid, or the unique benefits provided by such a fluid as previously discussed. Although the references mention the inclusion of some aliphatic molecules in polishing fluids, such molecules are not taught as being useful for providing high selectivity and removing a dishing effect in the polishing process. Kubota discloses at least a hundred different surfactants, and teaches away from using a surfactant having anywhere near the high molecular weight of the surfactant used in the CMP fluid of the present invention. The only discussion in Kubota of the surfactant weight is in Examples 1 and 2, in which the most massive surfactant has a molecular weight of 300. Moeggenborg discloses hundreds of surfactants, some of which are very light and some of which are somewhat heavy. However, Moeggenborg fails to disclose a weight range that anticipates or even overlaps the range of 2,000 to 240,000 as presently claimed, and further fails to disclose any benefit that would arise from choosing a high molecular weight surfactant. Hattori discloses numerous potential surfactants, including some at higher molecular weights, but fails to provide any teachings regarding the benefits of using a surfactant at the specific weight range presently claimed in an abrasive-free CMP fluid. Thus, it is clear that a person of ordinary skill in the art would not be motivated from reviewing the cited prior art to find any value from an abrasive-free CMP fluid having a high molecular weight surfactant as presently claimed. Because Kubota, Moeggenborg, and Hattori, alone or in combination, fail to teach or suggest the features of the independent claims 1, 7, and 13, it is respectfully submitted that the rejections under 35 U.S.C. § 103 should be withdrawn.

C. Conclusion

In view of Applicant's amendments and remarks, it is respectfully submitted that Examiner's objections and rejections have been overcome. Accordingly, Applicants respectfully submit that the application is now in condition for allowance, and such allowance

is therefore earnestly requested. Should the Examiner have any questions or wish to further discuss this application, Applicants request that the Examiner contact the Applicants attorneys at the below-listed telephone number.

If for some reason Applicants have not requested a sufficient extension and/or have not paid a sufficient fee for this response and/or for the extension necessary to prevent abandonment on this application, please consider this as a request for an extension for the required time period and/or authorization to charge Deposit Account No. 50-2091 for any fee which may be due.

Respectfully submitted,

INGRASSIA FISHER & LORENZ

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By: /David K. Benson/
David K. Benson
Reg. No. 42,314
(480) 385-5060
Customer No. 29906